

then shaping the sheet of glass accurately with said suction mold by developing a first vacuum in said first suction chamber at a first time to attract a first area of the sheet of glass against the first shaping surface area to shape the first area of the sheet of glass and then developing a second vacuum in said second suction chamber at a second time to attract a second area of the sheet of glass against the second shaping surface area to shape the second area of the sheet of glass complementary to the first area, said first time being before said second time so that the sheet of glass is successively brought against the first and second shaping surface areas wherein said sheet of glass is bent successively and gradually; and

then without further shaping, directly releasing the sheet of glass from the first and second shaping surface areas of the suction mold onto a quenching ring and moving the sheet of glass on the quenching ring to quenching.

REMARKS

Claim 10 has been amended. Claims 5-8 and 10 remain pending. Reconsideration and reexamination of the application, as amended, are requested.

The Examiner rejected claims 5-8 and 10 under 35 U.S.C. 103(a) as being obvious on consideration of Seymour '104 in view of Seymour '200.

Applicants renew this argument in the paper "Amendment under Rule 111" filed January 28, 2003. The Seymour references were discussed therein. In addition, Applicants further distinguish herein claim 10 from a reasonable consideration of these references by one skilled in the art. In this regard, Applicants thank the Examiner for meeting with the undersigned Applicants' attorney on April 15, 2003, to discuss the present rejection. The present response reflects that discussion.

It is deemed helpful to discuss portions of the "Description of the Prior Art" in the present specification. In this regard, Japanese Patent Publication No. 62-30136 is referenced and discussed at page 1, line 23 to page 2, line 2, as follows:

According to the method disclosed in the latter publication, a heated sheet of glass is lifted by a ring mold and pressed against the shaping surface of a suction mold, and then a vacuum is developed by the suction mold to draw the heated sheet of glass against the shaping surface of the suction mold to bend the heated sheet of glass to a desired shape complementary to the shaping surface. (emphasis added)

The reference is further discussed by indicating that a large amount of air must be used by the suction mold. To solve the problem, the prior art developed a suction mold divided into a plurality of chambers.

Japanese Laid-Open Utility Model Publication No. 63-27443 is discussed at page 2, lines 17-27, as follows:

More specifically, Fig. 8A in the accompanying drawings shows a conventional suction mold 100 having a downwardly convex shaping surface. In Fig. 8A, a heated glass sheet G has its peripheral edge pressed against the peripheral edge of the shaping surface of the suction mold 100 by a ring mold 101. When the suction mold 100 starts drawing the heated glass sheet G under section pressures developed therein, air may locally be not removed from and may remain trapped between the glass sheet G and the shaping surface of the suction mold 100, as shown in Fig. 8B of the accompanying drawings. ... (emphasis added)

In addition, Japanese Laid-Open Patent Publication No. 59-232926 is discussed, at page 3, lines 3-11, as follows:

Fig. 9A of the accompanying drawings shows another conventional suction mold 110 of the reversal type having a concave/convex shaping surface. In Fig. 9A, a heated glass sheet G has its peripheral edge pressed against the peripheral edge of the shaping surface of the suction mold 110. When the suction mold 110 starts drawing the heated glass sheet G under suction pressures developed therein, the heated glass sheet G may not be stretched sufficiently, and may be ruptured as shown in Fig. 9B of the accompanying drawings. (emphasis added)

Then, in the first paragraph of the "Summary of the Invention" at page 3, lines 13-18, it is stated:

It is therefore an object of the present invention to provide a method of bending a sheet of glass accurately to a desired shape with a suction mold, without trapping air between the sheet of glass and the shaping surface of the suction mold, or rupturing the sheet of glass or developing undue stresses in the sheet of glass.

It is pointed out that these references very specifically are discussed with respect to a ring mold "pressing" the sheet of glass against the shaping surface of the suction mold, and the suction mold then "drawing" the sheet of glass against the shaping surface of the suction mold. Each of the devices of the references have problems. In the case of 63-27443, because the ring mold presses the sheet of glass against the shaping surface of the suction mold, and the suction mold then draws the sheet of glass, air is trapped. In the case of 59-232926, the peripheral edge of the sheet of glass is pressed against the shaping surface of the suction mold so that when the suction mold starts drawing the glass sheet, the glass sheet may be stretched and ruptured. It is the pressing of the sheet of glass against the suction mold by the ring mold which leads to these problems.

In the "Summary of the Invention", it is stated:

It is therefore an object of the present invention to provide a method of bending a sheet of glass accurately to a desired shape with a suction mold, without trapping air between the sheet of glass and the shaping surface of the suction mold, or rupturing the sheet of glass or developing undue stresses in the sheet of glass.

The present invention is then partially discussed at page 8, line 16 to page 9, line 22, as follows:

The suction mold 3 is continuously lowered until it nears its lowermost position, i.e., the shaping surface 31 approaches the glass sheet G on the ring mold 4, the central area of the glass sheet G is attracted to the area of the shaping surface 31 which

corresponds to the central suction chamber C1 under the vacuum developed in the central suction chamber C1, as shown in Fig. 4. (emphasis added)

...

At the same time that the central area of the glass sheet G is attracted, the valve 38 is closed to apply a vacuum developed by the vacuum generating device 39 into the side suction chambers C2, C3. Therefore, opposite areas of the glass sheet G are attracted to respective opposite side areas of the shaping surface 31 which correspond to the side suction chamber C2, C3. ... (emphasis added)

Since a vacuum or suction pressure is developed at different times in the central and side suction chambers C1, C2, C3, the glass sheet G is bent successively and gradually from one area to another, i.e., from the central area to the side areas thereof. Consequently, when the glass sheet G is bent, no air is trapped between the shaping surface 31 and the glass sheet G, and the glass sheet G is prevented from being ruptured or developing undue stresses therein, but can be bent accurately to a desired shape.

As is clear from the disclosure of the specification, the invention excludes a pressing of the sheet of glass by the ring mold against the shaping surface of the suction mold. The language in the "Background of the Invention" uses "presses" and "draws". The language in the "Detailed Description of the Preferred Embodiments" when discussing the present invention uses "approaches" and "attracts".

Claim 10 has been amended to make it clear that the ring mold "approaches" and thereby, from a contextual reading of the language of the specification, the ring mold does not "press". That is, claim 10 requires "lowering said suction mold toward said ring mold to an extent that the first shaping surface area approaches the sheet of glass on said ring mold". The sense of the specification with the difference in language makes it clear by use of "approaches" that the ring mold does not "press" the sheet of glass against the shaping surface of the suction mold. Furthermore, use of the word "attracts" in claim 10 further distinguishes the idea that there is not a pressing of the sheet of glass against the shaping surface of the suction mold. In this regard, the discussion of the prior art uses the word "draws" when there is such a pressing. In distinction, claim 10 uses the word "attracts" such that the attracting is done at different and successive times so that because there is no peripheral pressing, the sheet of glass is bent successively and gradually. In this way, the problems of the prior art are solved.

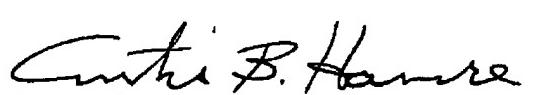
It is submitted that claim 10 as properly understood to exclude a pressing by the ring mold against the shaping surface of the suction mold solves the problems of the prior art and is even further distinguished from the "sandwiching" of the Seymour references. It is submitted claim 10 is not obvious in view of the Seymour references.

In view of the above, it is submitted that the application is in condition for allowance. Reconsideration and reexamination are requested. Allowance of claims 5-8 and 10 at an early date is solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADEIn the Claims

Claim 10 has been amended as follows:

10. (Three Times Amended) A method of shaping a sheet of glass heated nearly to a softening point thereof with a suction mold including first and second suction chambers having respective first and second shaping surface areas, comprising the steps of:

placing the sheet of glass on a ring mold;

lowering said suction mold toward said ring mold to an extent that the first shaping surface [areas come close to] area approaches the sheet of glass on said ring mold;

then shaping the sheet of glass accurately with said suction mold by developing a first vacuum in said first suction chamber at a first time to attract a first area of the sheet of glass against the first shaping surface area to shape the first area of the sheet of glass and then developing a second vacuum in said second suction chamber at a second time to attract a second area of the sheet of glass against the second shaping surface area to shape the second area of the sheet of glass complementary to the first area, said first time being before said second time so that the sheet of glass is successively brought against the first and second shaping surface areas wherein said sheet of glass is bent successively and gradually; and

then without further shaping, directly releasing the sheet of glass from the first and second shaping surface areas of the suction mold onto a quenching ring and moving the sheet of glass on the quenching ring to quenching.